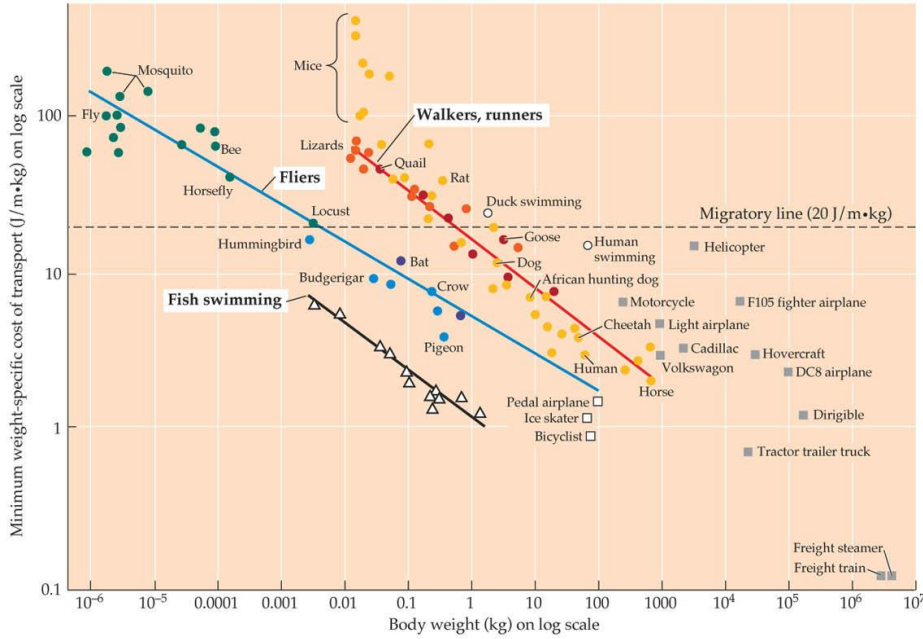


Lecture 23 handouts - Energetic extremes



KEY

- Walkers, runners**
 - Mammals (yellow circle)
 - Reptiles (orange circle)
 - Birds (red circle)
- Fliers**
 - Insects (green circle)
 - Birds (blue circle)
 - Mammals (purple circle)
- Fish swimming** (black triangle)
- Machines** (grey square)
- Humans using manufactured devices** (white square)
- Surface swimmers** (white circle)

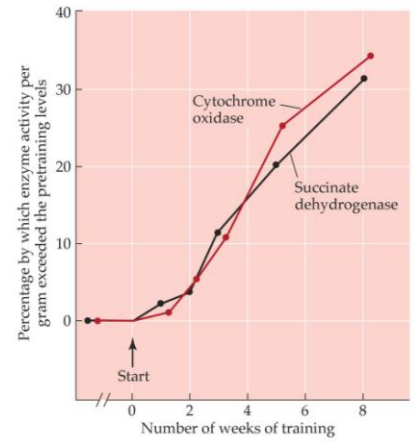
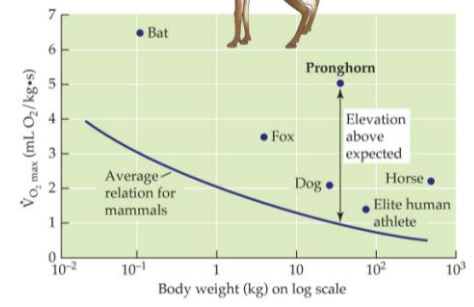
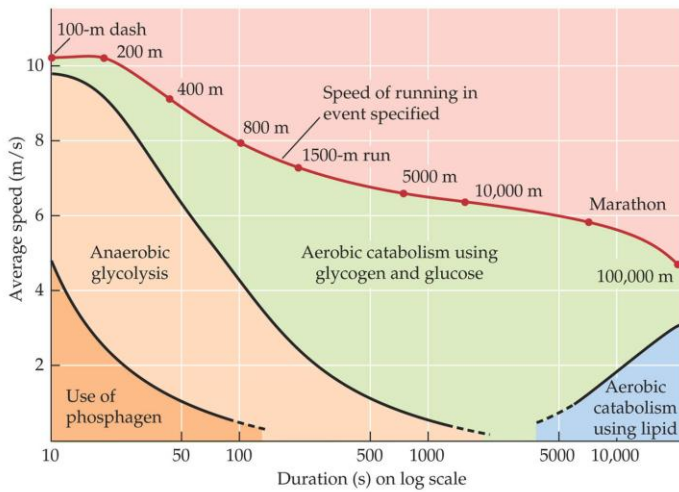


TABLE 7.4 Average $\dot{V}_{O_{2max}}$ in male Swedish athletes who compete in various events at the world-class level

Event (or other category)	Average $\dot{V}_{O_{2max}}$ (mL O ₂ /kg•minute)
Highest values ever recorded	90-95
Cross-country skiing	84
Long-distance running	83
Canoeing	67
Ice hockey	63
Soccer	58
Weight lifting	53
Gymnastics	52
General population (young adult Swedish men)	44

Source: After Astrand and Rodahl 1986.



Phases of Starvation:

Phase I - hepatic glycogen stores are almost completely utilized

- mobilization of stored lipids is activated - body switches to lipid oxidation to prevent protein catabolism

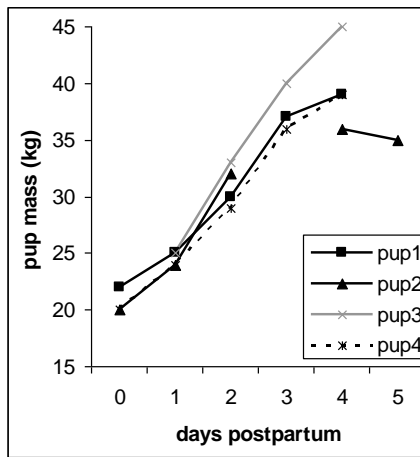
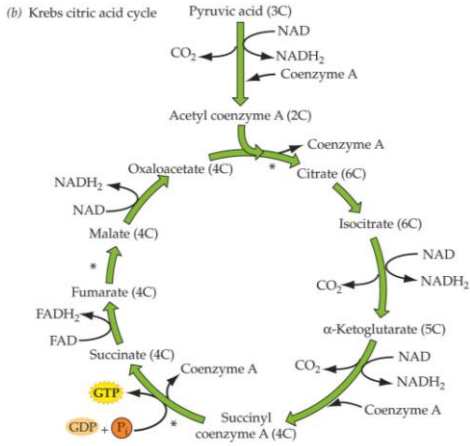
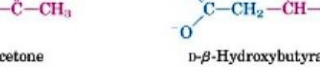
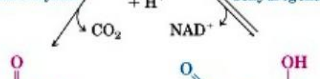
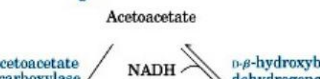
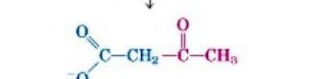
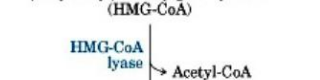
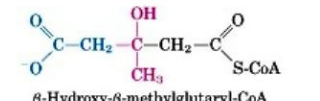
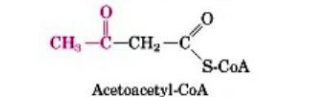
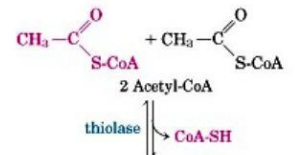
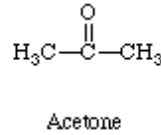
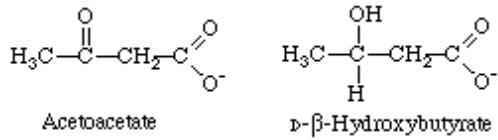
Phase II - increased oxidation of lipids, the production of ketone bodies, and the partial sparing of protein

- lipid oxidation provides ATP for body, and production of ketone bodies and gluconeogenesis provides fuel for CNS

Phase III - cardiac muscle is one of the first sources of protein that is utilized as the body catabolizes protein in order to supply the CNS with glucose via gluconeogenesis

- entered when 30-50% of body protein has been wasted

- At this point, lipid utilization falls, circulating ketones decline and the animal is at risk of starving to death; "Terminal starvation"



Data from Iverson & Bowen (various studies); Robin et al. 1998

